REMARKS

I. PENDING CLAIMS AND SUPPORT FOR AMENDMENTS

Upon entry of this amendment, claims 1-16 and 70-73 will be pending in this application.

Applicants have amended claims 1 and 13 to use active voice and to clarify that the forging produces grain size refinement, as disclosed in the specification at page 3, lines 7-9. Claims 9, 10, and 16 have been amended to clarify that the grain size given is an average grain size. Support for this amendment can be found in the specification at page 10, lines 12-13. Claims 9-11 have been amended to clarify that the values recited are obtained after casting and before forging.

New claims 70-73 are supported by the specification at page 9, lines 17-19.

No new matter has been added.

II. PROPOSED DRAWING CORRECTION

In paragraph 6 of the Office action, the Examiner has objected to Figures 1, 6a, 6b, 8a, and 8b, requiring that the drawings contain the legend "Prior Art." Applicants submit herewith proposed drawing corrections for the Examiner's approval.

III. OBJECTION TO SPECIFICATION

In paragraph 7 of the Office action, the Examiner has objected to the specification as containing a typographical error. By amendment to the specification, Applicants have corrected this error, and the Examiner's objection should be withdrawn.

IV. OBVIOUSNESS REJECTIONS

A. Titanium '95: Science and Technology

In paragraph 9 of the Office action, the Examiner has rejected claims 1-12 as obvious under 35 U.S.C. § 103(a) over the publication Titanium '95: Science and Technology. Applicants respectfully traverse this rejection and request reconsideration and withdrawal thereof.

The Examiner states that "Titanium '95 discloses a process for producing a component, the process comprising casting a blank . . . and subsequently forging the blank to produce the component," citing pages 693-695 of the cited reference. However, the Examiner's statement is incorrect. Nowhere does Titanium '95 describe or suggest forging the cast part to refine its microstructure.

The Examiner may have confused hot isostatic pressing, which is suggested in Titanium '95, with forging, which is not. However, these are two completely different processes, with completely different goals and effects, and result in very different materials. Hot isostatic pressing is a procedure for consolidating and densifying a material. In effect, the material is heated and subjected to a constant pressure, so that crystal grains can move relative to each other. The grains slip past each other and fill voids in the material, increasing its density. The key feature is that grains move relative to each other. The purpose of the process is not to change the grain size, or to modify the microstructure of the material, other than to densify it.

By contrast, forging the material results in microstructure refinement. In other words, by repeated application of high strain rate impacts, dislocations are introduced into the grains themselves. Further forging causes the dislocations to move through

the grains; and this migration results in the dislocations organizing into networks of so-called "dislocation cells" within the grain. Further forging causes these dislocation cells to rotate relative to each other, forming high angle "grain boundaries," effectively forming grains within the grains, and thereby decreasing the average grain size of the microstructure.

Thus, hot isostatic pressing is concerned with movement of grains relative to each other to fill voids between the grains in the material microstructure. Forging is concerned with the introduction, movement, and organization of dislocations inside the grains to form dislocation cells, and the conversion of these dislocation cell walls into grain boundaries, forming grains within grains.

Clearly, Titanium '95 fails to teach forging cast material, as recited in Applicants' claims. Moreover, Applicants note that the purpose to which Titanium '95 puts its cast material (aerospace and automotive valve stems, for example) does not require the type of fine grained microstructure needed in orthopedic applications. As a result, there would be no reason for one of ordinary skill in the art, when put in view of the disclosure of Titanium '95, to modify the process taught therein by adding a forging step. Such a step would be an unnecessary, expensive procedure that would add cost to the production of parts in an industry already quite cost sensitive (see Titanium '95, page 692, line 1, "Commercial and military customers are currently demanding high levels of cost accountability from the aerospace industry . . . . As a consequence, the U.S. aerospace industry is very interested in applying new technologies that can reduce the cost of manufacturing aircraft components.").

In addition, the Examiner notes that "For claims 2-6, Applicant should note that the claimed alloys are conventionally used in casting." Apparently this rather sweeping generalization is intended to replace some actual cited reference showing that cobalt chrome, Co-28Cr-6Mo and stainless steel alloys are conventionally used in casting aerospace and automotive hardware. If the Examiner has personal knowledge that these alloys have been cast in the aerospace or automotive industries, he should make that knowledge of record in a declaration under 37 C.F.R. § 1.104(d)(2). Absent that, unsupported allegations that these alloys have been cast in some industry is of no moment to the Examiner's rejection. For one thing, the unsupported nature of the allegation renders it inapplicable. For another, there is no motivation to combine the alleged fact, even if true, with the teachings of Titanium '95. Finally, even if the fact were true and were properly combinable with the cited reference, there is no teaching of forging, as recited in the claims.

Because the cited reference fails to teach or suggest the use of forging in combination with metal mold casting, the Examiner has failed to establish a *prima facie* case of obviousness, and this rejection should be withdrawn.

B. Titanium '95 in view of High Temperature Metal Mold Casting

In paragraph 10 of the Office action, the Examiner rejects claim 7 as obvious under 35 U.S.C. § 103(a) over Titanium '95 in view of High Temperature Metal Mold Casting (HTMMC). Applicants respectfully traverse this rejection and request reconsideration and withdrawal thereof.

The Examiner cites HTMMC for its alleged disclosure of a gravity mold. Without taking a position on whether HTMMC in fact discloses a gravity mold, Applicants respectfully submit that the Examiner has failed to establish a prima facie case of obviousness, and that this rejection should be withdrawn.

Titanium '95 fails to teach or suggest forging, as explained in detail above. HTMMC fails to cure this deficiency. As a result, the combination of references fails to render claim 7 obvious.

C. Titanium '95 in view of Vacuum Diecasting

In paragraph 11 of the Office action, the Examiner has rejected claims 8-12 as obvious under 35 U.S.C. § 103(a) over Titanium '95 in view of Vacuum Diecasting (VC). Applicants respectfully traverse this rejection and request reconsideration and withdrawal thereof.

The Examiner appears to cite VC to allegedly teach the use of a vacuum metal mold. Again, Applicants take no position on the accuracy of this assertion; because neither reference teaches or suggests forging the cast component. To the contrary, VC discourages one of ordinary skill in the art from using forging on a vacuum diecast material, because it states that the microstructure obtained from the casting process alone provides properties similar to those obtained with wrought titanium. Absent such a teaching to combine casting and forging, the Examiner has failed to establish a *prima facie* case of obviousness, and the rejection should be withdrawn.

D. Titanium '95, Standard Specification F 75-98, VC, and HTMMC

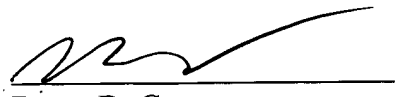
In paragraph 12 of the Office action, the Examiner has rejected claims 13-16 s obvious under 35 U.S.C. § 103(a) over Titanium '95, Standard Specification F75-98, VC, and HTMMC. Applicants respectfully traverse this rejection and request reconsideration and withdrawal thereof.

As Applicants have explained above in detail, none of the cited references teaches or suggests forging a metal mold cast cobalt chrome alloy to further refine its microstructure. To the contrary, at least one of the references cited by the Examiner teaches away from such a procedure. As a result, the Examiner has failed to establish a *prima facie* case of obviousness, and this rejection should be withdrawn.

Applicants respectfully submit that, in light of the above remarks, the Examiner's rejections should be withdrawn, and that this application is in condition for immediate allowance. An early notification thereof is earnestly solicited. If the Examiner has any questions or believes that further amendments are necessary prior to allowance, he is respectfully requested to contact the undersigned to arrange an interview prior to the issuance of any final Office action.

The Commissioner is hereby authorized to charge any deficiencies or credit any overpayment to Deposit Order Account No. 11-0855.

Respectfully submitted,



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MARKED UP COPY OF AMENDMENTS TO SPECIFICATION

According to the present invention, wrought barstock used conventionally for forging feedstock is replaced with a metal mold cast bar, ~~perform~~ preform or other material exhibiting the required ductile strength and refined grain structure to be forgeable. Other methods for producing a bar or preform with a sufficient forgeability may be used such as metal powder consolidation forming, metal injection molding, solid free form fabrication, metal rapid prototyping, laser and electron beam forming, spray forming, and semi-solid forming processes, so long as the process provides sufficient heat transfer to impart a sufficiently rapid cooling rate in order to produce the fine grain structure and ductility, and, if desired, low-notch brittleness and other properties according to the present invention as discussed herein. This bar or preform may then be forged using a wrought process to produce grain size refinement and increase in material integrity. Thus, in addition to forming the pre-wrought material using a metal mold, there are at least two other categories of pre-wrought processes according to the present invention: (1) processes that achieve the necessary ductility and refined grain structure for wrought processing through rapid heat removal through the component or a quenching atmosphere; and (2) processes that achieve the necessary ductility and refined grain structure through consolidation of powder or semi-solid material under conditions which restrict coarsening of the grain structure.